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1 $y = \frac{(2x^2+3)}{(\ln 2x}$

$\ln y = \ln(2x^2+3) - \ln(\ln 2x)$

$\frac{1}{y}\frac{dy}{dx} = \frac{1}{2x^2+3} \cdot 4x - \frac{1}{\ln 2x} \cdot \frac{1}{x}$

$\frac{dy}{dx} = y\left[\frac{4x}{2x^2+3} - \frac{1}{x \ln 2x}\right]$

$\Rightarrow \frac{dy}{dx}$ at $x = 2.5$

$\frac{dy}{dx} = \frac{2(2.5)^2+3}{\ln 2(2.5)}\left[\frac{4(2.5)}{2(2.5)^2+3} - \frac{1}{2.5 \ln 2(2.5)}\right]$

$\frac{dy}{dx} = \frac{15.5}{1.609}\left[\frac{10}{15.5} - \frac{1}{4.024}\right]$

$\frac{dy}{dx} = \frac{15.5}{1.609}[0.897]$

$\frac{dy}{dx} = \frac{6.1535}{1.609}$

$\frac{dy}{dx} = 3.8244$

$\therefore \frac{dy}{dx}$ at $x = 25 \doteq 3.82$

Gradient : $\frac{dy}{dx}$

$$y = \frac{2x}{(x^2 - 5)}$$

$$\ln y = \ln(2x) - \ln(x^2 - 5)$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{1}{2x}\,2 - \frac{1}{x^2-5}\cdot 2x$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{2}{2x} - \frac{2x}{x^2-5}$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{1}{x} - \frac{2x}{x^2-5}$$

$$\frac{dy}{dx} = y\left[\frac{1}{x} - \frac{2x}{x^2-5}\right]$$

$$\frac{dy}{dx} = \frac{2x}{x^2-5}\left[\frac{1}{x} - \frac{2x}{x^2-5}\right]$$

$$\frac{dy}{dx} = m$$

$\therefore$ m at point $(2, -4)$:

$$m = \frac{2(2)}{2^2-5}\left[\frac{1}{2} - \frac{2(2)}{2^2-5}\right]$$

$$m = \frac{4}{-1}\left[\frac{1}{2} - \left(\frac{4}{-1}\right)\right]$$

$$m = -4\,[0.5 + 4]$$

$$m = -4 \times 4.5$$

$$m = -18$$

3 $z = 2x^5 \ln y$ find $\frac{dz}{dy}$ $du = 10x^4$ $dv = \frac{1}{y}$

$u \quad v$

$$\frac{dz}{dy} = \ln y \cdot 10x^4 + 2x^5 \cdot \frac{1}{y}$$

$$= 10x^4 \ln y + \frac{2x^5}{y}$$

4 $\int_0^2 x\sqrt{2x^2+1}\, dx$

let $u = \sqrt{2x^2+1}$

$u^2 = 2x+1$

$2x^2 = u^2 - 1$

$x^2 = \frac{u^2-1}{2}$

$$= \left[\frac{(2(2)^2+1)^2}{6}\right] - \left[\frac{(2(0)^2+1)^3}{6}\right]$$

$$= \frac{(\sqrt{9})^3}{6} - \frac{(\sqrt{1})^3}{6}$$

$$= \frac{3^3}{6} - \frac{1^3}{6}$$

$$= \frac{27}{6} - \frac{1}{6} = \frac{27-1}{6} = \frac{13}{3}$$

$$\therefore \int_0^2 x\,(2x^2+1)^{1/2}\,dx = \frac{13}{3} \text{ square units}$$